

REMARKS

Claims 1-21 are pending in the present application.

The Office Action objected to claim 14 due to an informality with respect to the unit, "angstroms", thereby requiring correction.

Claims 1, 14 and 18-20 were rejected under 35 USC §112, 2d paragraph.

Claims 1-2, 4-7, 12-13 and 15-16 were rejected under 35 USC §102(b) as being anticipated by U.S. 5,931,721 to Rose et al. ("Rose").

Claims 1, 3, 6-7, 16 and 18-21 were rejected under 35 USC §102(b) as being anticipated by U.S. 6,333,268 to Starov et al. ("Starov").

Claims 10 and 11 were rejected under 35 USC §103(a) as being unpatentable over Rose as applied to claim 1 above, and further in view of U.S. Pub. 2003/0010356 to Kuyel ("Kuyel").

Claims 1, 3, 6-9, 14 and 16-21 were rejected under USC §103(a) as being unpatentable over Starov, and in view of Rose.

Claims 10 and 11 were rejected under 35 USC §103(a) as being unpatentable over Starov and Rose as applied to claim 1 above, and further in view of Kuyel.

Claims 1-3, 6-9, 11 and 16-20 were rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-5, 7-8, 11, 13-14 and 12-21 of U.S. 6,949,145.

Claims 1-5, 8-9 and 12-15 were rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 3-11 and 13 of U.S. 6,852,173.

Claims 11 and 21 are canceled by this amendment. Accordingly, any rejections of these claims in the Office Action are now moot and will not be addressed in the remarks.

Applicants respectfully request reconsideration of the currently pending claims in view of the amendments above and the remarks which follow.

The following remarks are presented to address the objection to claim 14 and the rejection of claims 1, 14 and 18-20 under 35 USC §112, 2d paragraph.

Claim 14 has been amended to recite the unit "angstroms" as required in paragraph no. 1 of the Office Action. Accordingly, the objection to claim 14 should be withdrawn.

Claim 1 has been amended to delete the term "high vapor pressure", and to clarify the cleaning of the substrate surface to be with a "cryogenic stream." Support for this amendment can be found in the specification as originally filed at page 11, lines 10-15.

Claim 14 has also been amended to provide for antecedent support for the term "the liquid".

Claim 18 has been amended to clarify the pressure recited in said claim. Support for said amendment can be found at the specification as originally filed at page 9, lines 19-21.

Claim 19 has been amended to recite the gas selected. It respectfully is submitted that the feature "clean dry air" is that which would be understood by one skilled in the art and is permissible for purposes of claiming by applicant.

Claim 20 has been amended to clarify the feature "free radical initiator". Subject matter incorporated into claim 20 is that which was in claim 21 as originally filed. Accordingly, claim 21 is requested to be canceled.

It respectfully is submitted that claims 1, 14 and 18-20 as amended now comply with 35 USC § 112, 2d paragraph, and accordingly the rejection of said claims under § 112 should be withdrawn.

Further amendments have been made to the claims and such amendments are to matters of form, antecedent basis and support amongst claim terminology, better readability of the claims, and to properly recite claim features and interaction therebetween. It respectfully is submitted that no new subject matter has been incorporated into the claims by these amendments and entry of same is respectfully requested.

The following remarks are presented to address the rejection of the claims under 35 USC §102(b) as being anticipated separately by Rose and Starov.

In order for a claim to be anticipated by a reference and therefore unpatentable under 35 USC §102(b), the reference cited must disclose each and every element of the claimed invention.

Rose is cited in the Office Action to reject independent claim 1 under 35 USC §102(b). By this amendment, claim 1 has been amended and as such is not anticipated by Rose. Rose discloses using an aerosol and in fact, teaches away from use of liquid-based cleaning technologies for surface processing of, for example, semiconductor memories, printed circuits, flat panel displays, and CD-ROMs (Col. 1, Ins. 5-7, Ins. 65-67). Nowhere in Rose is there disclosed applying at least one fluid to the substrate surface as called for in amended independent claim 1. Nowhere in Rose is there disclosed the fluid being selected from a group consisting of a liquid having a vapor pressure greater than 5 kPa at 25°C, a reactive gas of the type which reacts with the contaminants, and vapor of a reactive liquid of the type which reacts with the contaminants, in combination with cleaning the substrate surface with a cryogenic stream, as called for in amended claim 1. Accordingly, Rose does not anticipate amended claim 1, or any of the claims dependent therefrom. Therefore, the rejection of claim 1 as amended and the claims dependent therefrom under 35 USC §102(b) in view of Rose should be withdrawn.

Starov discloses removing post-etch residues and other adherent matrices by exposing same to vapor phase solvents and transmitting megasonic energy through the solvent condensed on the substrate to the matrix. There is however no disclosure in Starov of "cleaning the substrate surface with a cryogenic stream" as called for in amended claim 1. Accordingly, amended claim 1 and the claims dependent therefrom are not anticipated by Starov. The statement in paragraph 6 of the Office Action and citation to Starov that the "... dens[ified] fluid cleaning step to substantially remove completely the remaining residues" is synonymous with the claimed feature herein of "cleaning the substrate surface with a cryogenic stream" is respectfully traversed. There is absolutely no disclosure in Starov or justification to equate the term "densified fluid cleaning" to

be synonymous with or anticipatory of the language of amended claim 1, which is "cleaning the substrate surface with a cryogenic stream." Accordingly, it respectfully is submitted that amended independent claim 1 is not anticipated by the disclosure of Starov and therefore, the rejection under 35 USC. §102(b) in view of Starov should be withdrawn.

The following remarks are presented to address the rejection of the claims under 35 USC §103 as being unpatentable over Starov in view of Rose.

Starov discloses, for example, that a plasma pretreatment may be used on bulk resist followed by a densified fluid cleaning step to substantially remove completely the remaining residues. This is accomplished by the plasma pretreatment chemically reacting the plasma species with the photoresistent residues and by mechanically altering the photoresistent residues, fragmenting them and/or making them more porous for the vapor phase solvent to penetrate into the photoresist and reside and react with them more effectively during the densified fluid cleaning step (Col. 3, Ins. 9-26). Starov also teaches to transmit sonic energy through solvent condensed on the adherent matrix to loosen fragments and particles on the substrate (Col. 4, Ins. 41-51).

There is however no disclosure in Starov of "cleaning the substrate surface with a cryogenic stream" as called for in amended claim 1 of the present invention. There would similarly be no expectation of one skilled in the art to combine Starov with the disclosure of Rose to arrive at the present invention and render same obvious in view of the combination of Starov and Rose. That is, there would be no incentive for one skilled in the art to seek to include the mechanical cryogenic cleaning technologies of Rose with Starov after becoming familiar with Starov, because Starov already discloses a mechanical cleaning step of transmitting megasonic energy from a probe into condensed solvent on the

adherent matrix of the substrate in order to mechanically remove the adherent matrix. It respectfully is submitted that one skilled in the art would not view Starov as deficient for not having a mechanical cleaning step to thereby cause one to seek out other mechanical cleaning steps. There is no reason, suggestion or guidance for one to add mechanical cleaning to Starov if Starov is not deficient in that teaching.

Reference in Starov to a “densified fluid cleaning” is directed to use of “high frequency sonic energy employed to agitate the densified fluid to help loosen particles and residues from the adherent matrix, thereby enhancing the removal process (Col. 3, Ins. 27-30). In effect, the densified fluid functions as a transmission medium through which megasonic energy is transmitted from a probe to the adherent matrix to break up and remove same. It respectfully is submitted that such a mechanical process disclosed in Starov would not lead one skilled in the art to search for and combine mechanical cryogenic cleaning as called for in amended claim 1. Similarly, to the extent that there is reference to the use of liquid in Starov, such as for example “liquid ammonia” (Col. 8, Ins. 60-62), this runs counter to the disclosure of Rose which, as discussed above, considers liquid-based cleaning technologies to be that which industry is moving away from. This further supports the position the one skilled in the art would not look to Rose to supplement any perceived shortcomings of Starov to arrive at the present invention.

Accordingly, it respectfully is submitted that there is no justification or reasoning for one skilled in the art to take the disclosure of Starov and seek out and combine it with Rose to arrive at the invention of amended claim 1. Therefore, it respectfully is submitted that claim 1 as amended herein and the claims which depend therefrom are patentably distinct from the combination of Starov in view of Rose.

Completed Terminal Disclaimers in view of U.S. Patent Nos. 6,949,145 and 6,852,173 are filed herewith to overcome the nonstatutory obviousness-type double patenting rejection of claims 1-3, 6-9, 11 and 16-21; and claims 1-5, 8-9 and 12-15, respectively. The Terminal Disclaimers are signed by the attorney of record. Entry of the Terminal Disclaimers is respectfully requested.

The other references cited in the Office Action, not having been relied upon for a rejection, are not thought to require further remarks at this time.

All issues raised in the Office Action are believed to have been addressed. In view of the foregoing amendments and remarks, favorable action on the merits, including entry of all amendments and the Terminal Disclaimers, and allowance of all claims pending, respectfully is requested.

The Examiner is invited to contact the undersigned by telephone to resolve any outstanding issues.

Respectfully submitted,

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